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Superfund Record of Decision (EPA Region 8) North Dakota Arsenic Trioxide in Southeastern North Dakota, September 1986

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September 1986

EPA

Superfund Record of Decision:

North Dakota Arsenic Trioxide, ND

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16. ABSTRACT

The North Dakota Arsenic Trioxide site consists of twenty townships in the Richland, Ransom, and Sargent counties in southeastern North Dakota. About 4,500 people live in this sparsely populated farmland area. Ground water use includes residential consumption, irrigation, and livestock watering. The contamination, limited to ground water, appears to have two sources: naturally occurring arsenic contained in shales native to the area; and an estimated 330,000 pounds of arsenic-laced bait used to control grasshopper infestations in the 1930s and 1940s. In 1979, during quality monitoring of the municipal water supplies, the Water Supply and Pollution Control division of the North Dakota State Department of Health detected elevated levels of arsenic in the towns of Lidgerwood and Wyndmere. Additional monitoring found widespread and highly variable occurrences of arsenic in rural areas. In the late 1970s, approximately 278 homes in Lidgenwood, which use private well systems, were considered to be at a health risk due to arsenic exposure. An emergency response action, to be instituted by the EPA and scheduled for implementation in 1986, will consist of installing point-of-use treatment units for affected households, and provide for further study of a former arsenic-bait mixing site at Wyndmere. The primary contaminant of concern is arsenic trioxide.

(See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field Group
Record of Decision North Dakota Arsenic Trioxide, ND Contaminated Media: gw Key contaminants: arsenic trioxide		

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North Dakota Arsenic Trioxide, ND

16. ABSTRACT (continued)

The selected remedial action for this site includes: expansion and hookup of homes to the existing Richland Rural Water System; construction and hookup of homes to a new rural water treatment and distribution system; and evaluation of institutional controls. The estimated capital cost for this selected remedy is $2,212,600 with annual O&M of $57,400.

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

SITE North Dakota Arsenic Trioxide in Southeastern North Dakota

DOCUMENTS REVIEWED

I am basing my decision primarily on the following documents describing the analysis of the cost-effectiveness of remedial alternatives for the North Dakota Arsenic Trioxide Site.

- Investigation of Arsenic in Southeastern North Dakota Ground Water, Remedial Investigation prepared by Division of Water Supply and Pollution Control, North Dakota State Department of Health dated December 1985.

- Health Risk Assessment prepared by the Division of Water Supply and Pollution Control, North Dakota State Department of Health, undated.

- Water Treatment Alternatives for the Reduction of Arsenic in Ground Water Supplies of southeastern North Dakota, Feasibility Study prepared by the North Dakota Division of Water Supply and Pollution Control dated July 1986.

- Removal Action Memorandum in support of the planned emergency removal action prepared by EPA Emergency Response Branch dated May 23, 1986 and amended on September 10, 1986.

- Technical Memorandum concerning ROD studies dated August 12, 1986 from Camp Dresser & McKee Inc. to EPA.

- Final Site Health Assessment prepared by the Agency for Toxic Substances and Disease Registry dated August 28, 1986.

- Summary of Remedial Alternatives.

- Responsiveness Summary.

DESCRIPTION OF SELECTED REMEDY

The Remedial Investigation and Feasibility Study evaluated alternatives to reduce effectively the exposure to arsenic-contaminated ground water in southeastern North Dakota. Contaminated ground water appears to have two sources. The first is from naturally occurring arsenic contained in shales native to the area. The background arsenic level in ground water was estimated to be 0.025 mg/l. The second source of contamination is from arsenic-containing bait that was used to control grasshopper infestations in the 1930s and 1940s. Ground water in this area is used for agricultural and domestic purposes. Agricultural use consists of irrigation and livestock watering. Domestic use is for residential consumption, and lawn and garden watering.

The selected remedy to reduce human exposure to arsenic-contaminated ground water that resulted from arsenic bait application is to provide treated water to households via a rural water distribution system. Presently, a portion of the study area has water supplied by the Richland Rural Water Distribution System. Expansion of this system combined with water supplied by a new rural treatment and distribution system, or a distribution system tied into the existing system, will provide water to residents that exceeds (i.e., is lower than) the applicable Federal public health requirement, which is the Maximum Contaminant Level (MCL) of the Safe Drinking Water Act. The selected remedy will provide arsenic removal to the background level. Institutional controls will be investigated further during detailed design, including restrictions on existing well use, restrictions on new well drilling, a well permitting system, and economic incentives for participation in the new distribution system and non-use of well water. Institutional controls that are feasible and implementable will be adopted. No action is required for those individuals using public water from the towns of Lidgerwood and Wyndmere due to effective removal of arsenic by the towns' water treatment systems.

Under the selected remedy, Federal funding will be required for the rural water system expansion. This will include both expansion of and hook-up of homes to the existing Richland Rural Water System, and construction of and hook-up of homes to a new rural water system. Federal funding will also be required for operation and maintenance of the rural water system, and continued monitoring of ground water. Continued monitoring will include quarterly water quality monitoring of the Lidgerwood and rural systems, annual monitoring of the Wyndmere system, annual monitoring of the representative glacial aquifer systems and random annual sampling of private wells outside the existing contamination boundaries. Federal funding will be required for 1 or 10 years depending upon the maximum allowed under reauthorization of CERCLA.

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300), I have determined that the expansion of the existing Richland Rural Water Distribution System and construction of a new rural water system at the North Dakota Arsenic Trioxide Site is a cost-effective remedy and provides adequate protection of public health and welfare. I have also determined that remedial action for adequate protection of the environment (specifically, restoration of ground water quality to background levels) is not technically feasible because of the large areal extent of ground water contamination (approximately 171 square miles), hydrogeological characteristics, and lack of a point source of contamination. The State of North Dakota has been consulted and agrees with the approved remedy. The action will require future operation and maintenance activities to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved action and eligible for Trust Fund monies for a period of 1 year, or 10 years if allowable under reauthorization of CERCLA.

I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies for use at other sites.

September 26, 1986
Date

Alexandra B. Smith
John G. Welles/pm
Regional Administrator

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

SITE LOCATION AND DESCRIPTION

The North Dakota Arsenic Trioxide Site is composed of 20 townships in three counties (Richland, Ransom and Sargent) in southeastern North Dakota encompassing about 568 square miles (Figure 1). Within this study area, arsenic was detected in the ground water in four separate regions (Figure 2) at levels at or above the Maximum Contaminant Level (MCL) of 0.05 mg/l set by the U.S. Environmental Protection Agency (EPA) pursuant to the Safe Drinking Water Act (SDWA). Included in these four regions are the small towns of Wyndmere and Lidgerwood as well as private homes and farms in rural areas. The affected area totals about 171 square miles.

This area of southeastern North Dakota is primarily sparsely populated farmland. About 4,500 people live in the entire study area with 971 in Lidgerwood and 550 in Wyndmere. Topography consists of gently rolling hills and relatively flat plains, much of which has been influenced by past lacustrine and glacial activity. Ground water systems include the deeper Dakota Sandstone aquifer (200 to 1,000 feet below land surface), and the more shallow glacial drift aquifers, (3 to 156 feet below land surface). Arsenic contamination appears to be limited to the seven major unconfined glacial drift aquifers.

SITE HISTORY

Arsenic-laced bait was used extensively throughout North Dakota to combat grasshopper infestations in the 1930s and early 1940s. During water quality monitoring of municipal supplies in 1979, the Water Supply and Pollution Control Division of the North Dakota State Department of Health detected elevated levels of arsenic in the towns of Lidgerwood and Wyndmere.

Additional monitoring found more widespread occurrence of arsenic in rural areas. The Division conducted a Remedial Investigation and Feasibility Study overseen by the EPA from 1982 to 1986. The Final RI report was issued in December 1985 and the FS report in July 1986.

Investigation of arsenic bait disposal methods and interviews with area residents indicated that contamination could have resulted from bait disposal although no specific disposal sites or contaminant sources were found. One former bait-mixing station was identified near Wyndmere.

Arsenic-contaminated ground water was determined to be a health risk in the late 1970s in Lidgerwood. The North Dakota State Department of Health ordered Lidgerwood to take appropriate measures to provide drinking water that met the MCL for arsenic (0.05 mg/l) as established by the SDWA. Several alternatives were evaluated. Lidgerwood built a new water treatment plant, overseen by the State under the SDWA. The plant was completed in 1986 and drinking water in Lidgerwood now meets the MCL of the

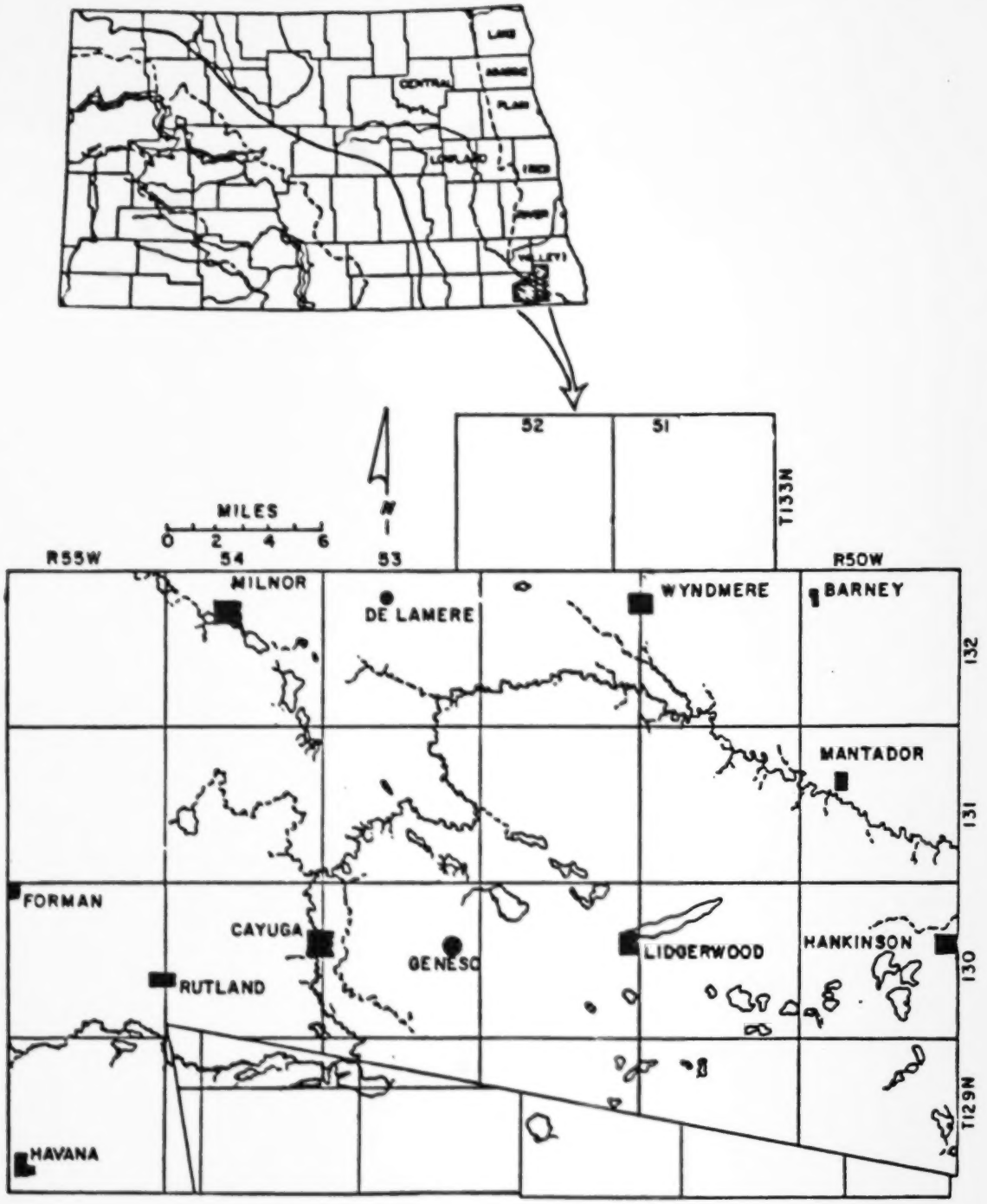
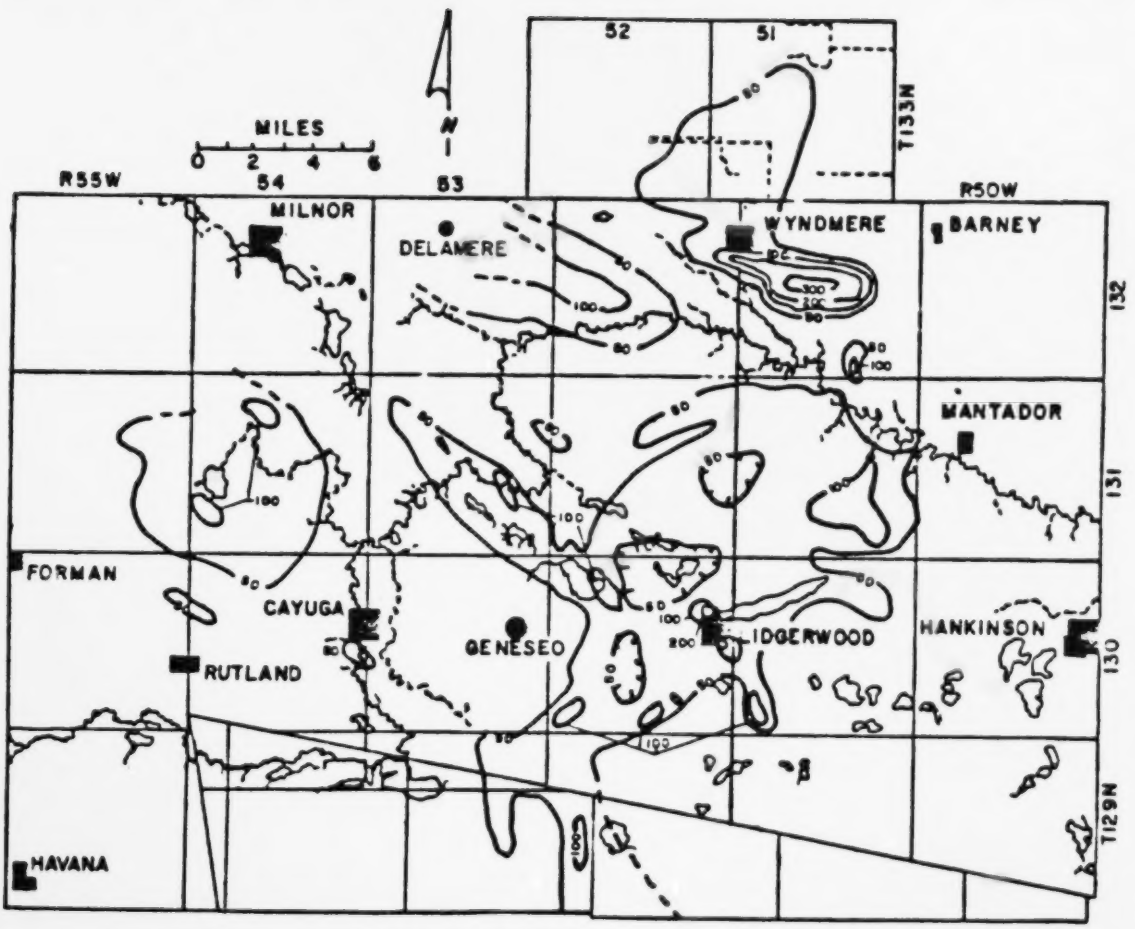


FIGURE 1 PROJECT AREA LOCATION



Contour interval in ug/l.

FIGURE 2 ISOCONCENTRATION MAP OF OBSERVED ARSENIC LEVELS IN GROUND WATER

SDWA. The rav water supply from ground water wells for the town of Wyndmere also exceeds the MCL for arsenic. However, Wyndmere's existing water treatment system is effective in removing arsenic.

CURRENT SITE STATUS

Chronic exposure to arsenic in humans causes characteristic toxic effects on the peripheral nervous system, and, in children, effects on the central nervous system. Acute arsenic poisoning in humans may result in gastrointestinal effects, hemolysis and neuropathy. Arsenic has been found to be embryotoxic, fetotoxic, and teratogenic in several animal species, but its ability to induce malformations in humans is less well substantiated. Arsenic's potential as a human carcinogen has long been recognized, but its carcinogenicity has been demonstrated only recently in animal models.

During conduct of the RI and FS, 704 samples from 558 ground water supply locations in an area of 568 square miles indicated arsenic levels in ground water ranging from undetected to 1.56 mg/l. Arsenic was found in ground water at levels at or above the MCL of 0.05 mg/l in four separate regions, totaling about 171 square miles. Figure 2 shows observed arsenic values in an arsenic isoconcentration map. Arsenic occurrence is widespread and in highly variable levels and locations.

The RI and FS concluded that the elevated levels of arsenic in ground water resulted both from use of arsenic-based grasshopper bait and naturally occurring sources. An estimated 330,000 pounds of arsenic trioxide bait may have been used in the entire study area. The background ground water arsenic level was estimated in the RI to be 0.025 mg/l.

Of the 4,500 persons living in the entire study area, an estimated 748 people in 278 homes are considered to be subject to increased health risk due to exposure to arsenic above the MCL in ground water supplies. Data are from the RI and Health Risk Assessment prepared by the North Dakota State Department of Health. Table 1 shows the population at risk by location and arsenic level. These people represent rural sites using private well systems.

As an interim measure, EPA instituted an emergency response action to address the immediate health impacts of the arsenic-contaminated ground water. EPA determined that an interim measure was necessary because the levels of arsenic in ground water exceeded the MCL and 10-day Health Advisory of 0.05 mg/l established by EPA. The emergency response action will consist of installation of activated alumina or other suitable point of use treatment units for one tap per affected household (arsenic concentration > 0.05 mg/l). The emergency response action is presently scheduled for implementation during the last quarter of 1986. The emergency response action also provides for further study of the former arsenic-bait mixing site at Wyndmere.

TABLE 1

POPULATION AT RISK WITHIN THE STUDY AREA[1]

Township	Population at risk per arsenic level (mg/l) 0.05-0.10	0.10-0.20	0.20-0.30	0.30-0.40	>0.40
Richland Co.					
Belford	-	-	-	-	-
Brightwood	-	-	-	-	-
Danton	27	0	3	5	-
Dexter	59	-	-	-	-
Duerr	16	-	-	-	-
Elma	-	-	-	-	-
Grant	140	25	0	6	3
Homestead	23	-	-	-	-
Liberty Grove	110	18	0	2	-
Morgan	36	14	-	-	-
West End	9	-	-	-	-
Wyndmere	34	5	7	-	-
Sargent Co.					
Dunbar	24	-	-	-	-
Hall	-	-	-	-	-
Herma	38	3	-	-	-
Kingston	24	-	-	-	-
Marboe	28	6	-	-	-
Ransom	10	-	-	-	-
Rutland	1	-	-	-	-
Shuman	66	6	-	-	-
Tewaukon	-	-	-	-	-
Weber	-	-	-	-	-
Cities					
Lidgerwood	-	-[2]	-	-	-
Wyndmere	-	-	-	-	-
Rutland	-	-	-	-	-
Totals	645	77	10	13	3

Total population at risk: 748

(1) Based on RI and Health Risk Assessment prepared by North Dakota State Department of Health.

(2) Formerly 971, but new treatment plant nov provides acceptable water.

ENFORCEMENT

Sporadic, devastating grasshopper infestations resulted in numerous arsenic bait control programs within the site. Identifiable Potential Responsible Parties (PRPs) include the numerous individuals and entities which participated in these programs.

Grasshopper infestations in the years between 1910 and 1950 resulted in Congressional funding to provide arsenic bait to the State and counties of North Dakota and a number of Federal-State cooperative programs. The U.S. Department of Agriculture apparently distributed Federal funds and assistance to the State, which through its extension service and county agents, facilitated distribution of arsenic bait to the counties and individual farmers and landowners. It also appears that the county governments funded and facilitated individual farmers' and landowners' use of arsenic bait, both independently and in conjunction with Federal funding.

Enforcement activity at the North Dakota Arsenic Trioxide site would be extremely difficult given the extensive involvement of numerous public and private entities and given the remaining questions concerning the extent, sources and cause of the ground water contamination. EPA recommends that the Hazardous Substances Response Trust Fund (Superfund) be used to finance remedial action, and that further investigation be conducted to evaluate and facilitate potential enforcement actions. State matching funds amounting to ten percent will be required before final remediation can begin.

ALTERNATIVES EVALUATION

The goal of the alternatives examined in the FS is to effectively mitigate and minimize threats to and provide adequate protection of public health and welfare and the environment. The alternatives examined to achieve this goal in the FS and Technical Memorandum were:

1. No Action

2. Point of Use/Point of Entry Treatment
   - o Distillation
   - o Activated Alumina
   - o Reverse Osmosis
   - o Bottled Water

3. Water Treatment Systems
   - o Community
   - o Rural Water

4. Total Ground Water Treatment

Alternatives were developed pursuant to 40 CFR 300.68(f). The SDWA standard of 0.05 mg/l of arsenic was identified as the applicable Federal public health requirement for this site. No off-site disposal alternatives are appropriate because contaminant source areas that require removal were

not found. The Point of Use alternatives provide for treatment at the point of use in a household. The Point of Entry alternatives provide for treatment at the point of entry for water into the household. The Point of Use alternatives would reduce the likelihood of present or future threat and provide significant protection of public health but would not attain applicable Federal public health requirements. The Point of Entry alternatives would attain the applicable Federal public health requirement, the Safe Drinking Water Act (SDWA) if installed, operated and maintained properly. The Community and Rural Water Treatment Systems and Ground Water Treatment alternatives would attain and exceed the applicable standard of the SDWA. The Ground Water Treatment alternative would also provide for protection of the environment as well as public health and welfare.

Alternatives were initially screened using the criteria of cost, effectiveness, and acceptable engineering practices as directed by 40 CFR Part 300.68(g). Costs including Operation and Maintenance (O&M) were considered for each alternative. Each alternative was screened by evaluating feasibility, applicability, and reliability. Effectiveness in protecting human health and welfare and the environment was also considered.

During the screening process, the No Action alternative was eliminated for the rural homeowners because it does not protect public health and welfare and the environment. Inhabitants would continue to remain at risk due to arsenic concentrations in drinking water above the 0.05 mg/l MCL (SDWA Standard). As discussed under Site History, the No Action alternative was retained as appropriate for the towns of Lidgerwood and Wyndmere because their water treatment systems currently remove arsenic and provide water that exceeds (i.e., is lower than) the MCL.

The ground water treatment alternative was eliminated during the screening process because it is not feasible for the location and condition at the site (40 CFR 300.68(g)(2)). A typical ground water treatment system involves extraction of contaminated water through a cluster of wells, treatment, and injection of the treated water back into the aquifer. To achieve a detailed analysis of this alternative, the contaminant plume boundaries and aquifer system (characteristics and interconnection) would have to be well defined. At this site, these characteristics would be nearly impossible to define because of the large study area and its complex hydrogeology. Treatment would not be feasible because a point source that would be treatable was not identified. Arsenic was observed in varying concentrations and at different aquifer depths throughout the region. An inordinant number of clusters of recovery wells constructed at varying depths over a very large area (171 square miles) would be required for adequate collection of contaminated water. Therefore, the ground water treatment alternative was determined to be technically infeasible due to the aquifer characteristics, the large area of contamination, and lack of a point source.

The remaining alternatives were evaluated in more detail according to 40 CFR Part 300.68(h) in the FS and Technical Memorandum. Alternatives were refined and specified in detail. Detailed cost estimates were developed.

Engineering implementation, reliability and constructability were evaluated. The evaluation included an assessment of the extent to which each alternative would effectively prevent, mitigate, or minimize threats to, and provide protection of public health, welfare and the environment and an analysis of adverse environmental impacts. Recycle/reuse and the other alternative technologies listed in 40 CFR 300.68(h)(v) were determined not to be appropriate for this site.

The various Point of Use/Point of Entry alternatives were evaluated in the FS and by EPA. These included activated alumina, reverse osmosis, distillation, and bottled water. The Point of Use/Point of Entry Alternatives are characterized by inherent variability and inconsistency associated with occupant operation and maintenance of the system. Therefore, because of lack of reliability and proper assurance of implementation and maintenance of these alternatives, adequate protection of public health could not be guaranteed. These types of technologies rely heavily on institutional controls and would not provide a permanent remedy. Point of Use systems also do not provide treatment for all of the water in the household. Therefore, it was determined that these alternatives would not effectively prevent, mitigate, or minimize threats to and provide protection of public health, welfare and the environment.

The rural water alternative involves expansion of the existing water system and construction of a new rural water distribution system. Centralized treatment and distribution of water that meets the MCL of the SDWA would be provided for rural residences with contaminated ground water within the affected regions. The alternative consists of expanding the Richland Rural Water Users Association (RWUA) system within its present boundaries, and creating another RWUA to serve other residents within the affected area but outside the existing Richland RWUA boundaries. Expansion of the distribution system for the Richland RWUA would be necessary. Current treatment capacity for expansion within the existing Richland RWUA is adequate.

The new RWUA would require construction of wells, a treatment system and a distribution system, or construction of a distribution system to tie into the existing Richland RWUA treatment system. It would utilize deep wells with co-precipitation of arsenic during iron and manganese removal. The proposed method would use aeration and/or chemical oxidants such as chlorine or potassium permanganate, followed by filtration through a high rate sand filter or natural green and zeolite (if additional reaction time is required). Construction of the new RWUA would be independent of the Richland RWUA. However, the two systems should be jointly managed to provide greater overall reliability and greater efficiency in administering the associations. It may be possible to connect to the Richland RWUA well and treatment system, in which case only a new distribution system would be required. Evaluation of institutional controls will occur during detailed design. This alternative will protect public health and welfare by removing arsenic in order to exceed the applicable drinking water standard.

Cost estimates for the alternatives that were evaluated in detail are presented in Table 2. The Point of Use/Point of Entry cost estimates were

TABLE 2

ALTERNATIVES COST ESTIMATES

FIRST YEAR

Alternative	Cost[1] Capital Per System	O&M	Total
Point of Use[2]			
Distillation	$275,000	$ 27,112	$ 302,112
Reverse Osmosis	200,000	18,000	218,000
Activated Alumina	50,000	2,500	52,500
Bottled Water	140,000	28,080	139,829
Rural Water Distribution[3] (Existing Richland RWUA and New RWUA)	2,212,600	57,400	2,270,000
Additional Yearly Monitoring Cost (All Alternatives)			6,000

(1) Point of use costs based on 250 units, rural water on 298 units (278 units currently affected plus an assumed 20 additional units that may be affected).

(2) Costs from FS. Note that costs do not include costs to operate, maintain and periodically replace individual well systems.

(3) Costs from Technical Memorandum.

taken from the FS and the Ground Water Treatment and Rural Water Distribution cost estimates were obtained from the Technical Memorandum from CDM to EPA.

COMMUNITY RELATIONS

The community's level and nature of concerns are summarized in the attached Community Responsiveness Summary.

CONSISTENCY WITH OTHER ENVIRONMENTAL REQUIREMENTS

Expansion of the rural water supply would comply with applicable environmental laws and regulations. A rural water system would provide water that attains and exceeds the Safe Drinking Water Act (SDWA) MCL for arsenic of 0.05 mg/l. A water treatment system will be built as part of the rural water supply. Sludge generated by the plant will be disposed of in accordance with applicable Resource Conservation and Recovery Act Standards.

Point of Use systems could provide water that meets the SDWA standard if installed, operated and maintained correctly but would not comply with the SDWA because all household water would not be treated. Point of Entry systems, if installed, operated, and maintained correctly, would provide water that meets the SDWA standard and would comply with the SDWA. However, it would be difficult to ensure that these systems were operated and maintained correctly. Some Point of Entry/Point of Use systems (e.g., activated alumina) generate solid waste that would be considered a hazardous waste. However, North Dakota Administrative Code 33-20-05-05 exempts household wastes from being classified as hazardous.

No waivers of compliance with other laws will be required for the selected alternative.

RECOMMENDED ALTERNATIVE

The rural water treatment and distribution system and no action in the towns of Lidgerwood and Wyndmere relative to the public water supply is the recommended alternative. In selecting this alternative from those which adequately protect public health and welfare, the criteria of cost, technology, reliability and administrative concerns were considered. The recommended alternative is a cost-effective alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare. The recommended alternative, expansion of the rural water system, is consistent with a permanent site remedy. The rural water system will be designed to provide water that attains and exceeds the SDWA MCL of 0.05 mg/l arsenic by removing arsenic to the background concentration of 0.025 mg/l.

Other alternatives examined did not provide a permanent solution and provide adequate public health protection (Point of Use Systems), or were not technically feasible (Ground Water Treatment). Although more costly than Point of Use Alternatives, the rural water system provides the most

reliable means of protecting public health and attaining and exceeding the SDWA MCL. Ground Water Treatment is the only alternative that would provide for protection of the environment; however, it is not technically feasible. Costs are summarized in Table 3 for both systems and detailed in Table 4 for expansion of the existing RWUA and Table 5 for the new RWUA.

At present, 90 of the 278 affected homes lie within the boundaries of the existing Richland RWUA boundaries. These homes will be connected to the Richland RWUA for a $500 connection fee, extension of a main line to each property, and addition of isolation gate valves. It is anticipated that pipes in these homes will not need to be replaced. Leaching tests conducted by the State indicate that any arsenic compounds in the mineral scale are not re-dissolved in the presence of chlorinated water. Costs are included for replacement of water heaters.

For the homes outside the existing Richland RWUA boundaries, a new system will be constructed. A new distribution system will be required and potentially a new treatment system depending upon the capacity of the existing Richland RWUA system. Costs for a new treatment system are included. The new system will be constructed similarly to the existing system in that distribution lines and treatment systems are sized primarily to supply in-house domestic use and minimal outside irrigation. Pipeline materials, supply pumps, storage systems, and treatment equipment will be selected to provide a reasonable balance between initial capital cost, installation costs and long range operation and maintenance cost. Therefore, methods and materials will be less rigorous and expensive than in major municipalities. Costs (shown in Tables 3 and 5) reflect (1) the generally lower labor costs for local unskilled and semi-skilled workers, (2) the use of smaller equipment available locally, (3) easy to install material, such as plastic well and spigot pipe, and (4) the general lack of utility conflicts, extensive road improvements, traffic controls, easement acquisition, or high administrative costs. To achieve low costs, the design engineer will need to understand the local situation and design the plans to allow maximum flexibility for contractors to use high production excavation equipment.

The majority of cost results from installation of distribution mains over a large area. Estimates are based on installation of 100 miles of new distribution pipe. The average service distance per home is estimated to be less than 2,000 linear feet. Private ground water wells will be disconnected from the residence, but will remain available for irrigation use. North Dakota Administrative Code, Section 33-17-01-19, forbids interconnection between individual water supplies and public water systems.

During final design, other institutional controls will be investigated further. Types of controls may include restrictions on existing well use, restrictions on new well drilling, a well permitting system, and economic incentives for participation in the rural water system and non-use of well water. Institutional controls that are feasible and implementable will be adopted.

OPERATION AND MAINTENANCE

Operation and maintenance (O&M) activities will be required to ensure the effectiveness of the rural water supply. O&M activities include a monthly water user charge from the RWUA based on actual costs to produce and distribute water including electric power, chlorine, chemicals, repairs and maintenance. Labor for a maintenance person/meter reader are also included. O&M costs are shown on tables 3, 4, and 5. Table 3 summarizes capital costs and O&M costs for the rural water supply for 1 year and 10 years.

In addition, the Water Supply and Pollution Control Division of the North Dakota State Department of Health estimate that $6,000 per year will be required to provide for a ground water monitoring program (see Table 3). This program will include (1) quarterly water quality monitoring at the Lidgerwood and rural water distribution systems, (2) annual monitoring of representative glacial aquifer systems, (3) random annual sampling of private well systems outside the existing contamination boundary limits, and (4) annual monitoring of the Wyndmere water treatment and distribution systems. If additional contaminated rural wells (above the MCL) are found, they will be added to the rural water system. If levels of arsenic increase in the town supplies, EPA would consider appropriate response action in the future.

SCHEDULE

The following key milestones have been established for this project:

Approve Remedial Action (sign ROD)	September 1986
Award Cooperative Agreement for Design	December 1986*
Initiate Design	January 1987
Begin Construction	May 1988

* Pending reauthorization of CERCLA

FUTURE ACTIONS

Long term O&M and monitoring will be required to maintain the effectiveness of the expanded and new rural water systems. No additional RI/FS projects or operable units are anticipated at the site, although further evaluation of minor types of institutional controls consistent with the selected remedy will occur during the design phase.

TABLE 3

COSTS FOR RURAL WATER DISTRIBUTION

Expansion of Richland RWUA	
Expansion and First Year O&M Costs	$ 305,000
Establish New RWUA	
Construction and First Year O&M Costs	1,985,000
Total Cost to 298 Homes with 1 Year O&M	2,290,000
Plus 1 Year Monitoring	6,000
Total (1 Year)	$2,296,000
Total Cost to 298 Homes with 1 Year O&M	$2,296,000
Additional 9 Years O&M - Richland RWUA	236,000
Additional 9 Years O&M - New RWUA	360,000
Additional 9 Years Monitoring	54,000
Total (10 Years)	$2,940,000

(1) Assumes 278 existing homes with contaminated water and 20 new homes.

TABLE 4

EXISTING RICHLAND RWUA

Costs identified below are for connection of the 90 homes presently within the boundaries.

1. System Connection Fee - Represents individual share of existing common facilities or required upgrading and service line installation including meter, pit and tapping saddle.		
90 homes @ $500/home		$ 45,000
2. 4" dia. mainline extension - Average length assumed to be 1,000 l.f. based on reducing the 1,000 l.f. service line length described in the Feasibility Study to a short stub.		
Material Cost	$1.10	
Installation Cost Using Trencher	1.00	
	$2.10 l.f.	
90 homes - 1,000 l.f. x 2.10/l.f.		189,000
3. Disconnection of plumbing from existing system and connection to new system (4 hrs x $20/hr per home)		
90 homes x $80/home		8,000
4. Replacement of water heater if contaminated with arsenic		
90 homes @ $150/home		14,000
SUB-TOTAL INITIAL COST		256,000
Cost per unit $2,850/home		
5. Cost for including an additional 5 homes which are not currently experiencing arsenic problems.		
5 homes @ $2,850/home		19,000
6. First year O&M costs based on $26/2,000 gallon/ month minimum plus incremental cost of $1.50/1,000 additional gallons for 6,000 gallons/month		
95 homes x $372/home		35,000
TOTAL INITIAL COST		$305,000
Cost for an additional 9 yrs of O&M costs based on $26/2,000 gallon/month minimum. Includes present worth at 9 percent per annum interest rate and inflation at 5 percent per annum.		
Present worth factor (6.731 x 35,000)		$236,000

TABLE 5

ESTABLISH RWUA TO SERVICE AREAS NOT
INCLUDED IN RICHLAND RWUA

Costs identified below are for connection of 188 homes (278 homes less 90 within Richland RWUA) to a rural water system.

1. Main Distribution System - Est. 100 miles to basically bisect the 11 affected townships.

   Material cost 4" Class 160 psi PVC pressure pipe $0.90/l.f.

   Upgrade to Class 200 psi PVC pressure pipe $0.20/l.f.

   Installation cost assuming using trenching machine along side the main roadway and no bedding installation $1.00 l.f.

   Total Pipe Cost $2.10/l.f.

   100 miles x 5280 $\frac{\text{l.f.}}{\text{mile}}$ x $2.10/l.f. — $1,110,000

2. 4" Gate Valves at average spacing of 1/2 mile

   200 gate valves @ $250/ea installed — 50,000

3. Air and vacuum valves average 1 per 10 miles

   10 air/vacuum valves @ $750/ea installed — 7,500

4. 2 Standpipe Reservoirs @ 30,000 gal/ea. Estimated costs including site preparation, piping, painting $0.75/gallon

   2 x 30,000 gal x $0.75/gallon — 45,000

5. 2 Booster Pump Stations including:

   2 3 Hp booster pumps each station at $1,5000 each including electrical

   4 x $1,500/ea — 6,000

   2 10'x10' Pump Building @ $40/ft including electrical and piping — 8,000

TABLE 5

ESTABLISH RWUA TO SERVICE AREAS NOT
INCLUDED IN RICHLAND RWUA (cont.)

6.	1 deep well 50 to 100 gpm capacity	
	188 home @ 3 p/u (people/unit) x 70 gpcd = 40,000 gpd or 30 gpm	
	8" well 150 ft deep drilling and casing	3,000
	mobilization 1/2 day	500
	6" stainless steel screen, 30 ft @ $100/ft	3,000
	screen fittings	100
	sand pack and development	500
	5 Hp submersible pump w/drop 2-1/2" drop pipe and electrical panel	5,500
7.	40,000 gpd iron and manganese treatment system including chlorination @ $0.65/gallon	26,000
8.	50'x50' Backwash Pond 500 yd excavation @ $5/yd plus $1/ft square surface prep	5,000
	Lining of pond $1.25/sq ft	3,100
9.	Well and treatment building 15'x20' @ $30/ft including piping and electrical	9,000
10.	Service line installation - average length assumed to be 1,000 l.f. of 1 1/2" polyethylene service line. 1 1/2" diameter used to reduce head loss on long services.	
	Material Cost $0.65/l.f.	
	Installation cost using trencher $1.00/l.f.	
	$1.65 l.f.	
	188 homes x 1000 l.f. x $1.65/l.f.	310,000
11.	Water meters, pit, valves, tapping saddle and Pressure Reducing Valve	
	188 homes x $350/home	66,000
12.	Disconnection of existing plumbing	
	188 homes x $80/home	15,000

TABLE 5

ESTABLISH RWUA TO SERVICE AREAS NOT INCLUDED IN RICHLAND RWUA (conc.)

13. Replace water heater	
188 homes @ $150/home	28,000
CONSTRUCTION COST SUB-TOTAL	$1,700,000
14. Engineering Cost for expanded system estimated @ 10 percent of construction cost	170,000
SUB TOTAL INITIAL SYSTEM COST	$1,870,000
15. Cost for including an additional 15 homes which are not currently experiencing arsenic problems. Unit costs were calculated assuming that additional extensive distribution lines would not have to be constructed.	
$760,000 ÷ 188 homes = $4,000/home 15 homes @ $4,000	60,000
16. First year O&M costs based on actual cost to produce and distribute water including electric power, chlorine, chemicals, repairs and maintenance, est. to be $1.50/1000 gallon	
(188 + 15) homes x 3 p/u x 70 gpd x 365 days/yr x $\frac{\$1.50}{1000 \text{ gallon}}$	23,400
1 full time maintenance man and meter reader	
$30,000/yr w/benefit	30,000
TOTAL INITIAL COST	$1,985,000
Cost for an additional 9 yrs of O&M costs based on $37,000/yr (production and labor cost listed above). Present worth at 9 percent per annum interest and inflation at 5 percent per annum.	
Present Worth (6.75 x 53,400/yr)	$360,000

RESPONSIVENESS SUMMARY

NORTH DAKOTA ARSENIC TRIOXIDE SUPERFUND SITE

This responsiveness summary is prepared to accompany the Record of Decision announcing EPA's selected remedial action at the North Dakota Arsenic Trioxide site.

BACKGROUND OF COMMUNITY RELATIONS

The site was listed on the NPL in 1981 after routine State sampling in 1979 and 1980 indicated arsenic levels above the MCL in drinking water supplies in the towns of Lidgerwood and Wyndmere, along with more than 100 private wells in the rural area. The State of North Dakota assumed the lead for activities, including community relations.

In March 1982, the North Dakota State Dept. of Health (NDSDH) and EPA conducted a public meeting in the town of Lidgerwood to discuss the arsenic levels in the municipal water supply and in private wells in the study area. According to a newspaper story of April 1, 1982 in the Lidgerwood MONITOR, approximately 50 people attended the meeting. Many of those people had wells which were tested and they were interested in getting further explanation of what the test results meant.

Throughout 1982 and 1983, NDSDH staff continued to meet with Lidgerwood city officials and State legislators to talk about contamination and possible solutions. They talked with citizens in the area during continued testing of the water.

On March 25, 1983, the NDSDH issued a press release to all newspapers in North Dakota informing the general public of continuing testing of water supplies in the area.

The MONITOR again covered the progress of the NDSDH study in a story published August 18, 1983, and Fargo TV station KXJB covered the story on August 26, 1983.

In February 1984, NDSDH distributed a pamphlet entitled "Things You Should Know About the Arsenic Sampling of Water Supplies in the Rutland, Wyndmere, Lidgerwood Area (An Informal Discussion)" throughout the study area.

On February 26, 1986, a press release was issued by NDSDH announcing that public comments were being taken until March 31, 1986 on the draft Feasibility Study and that a public meeting was scheduled for March 25, 1986 in Lidgerwood to discuss the study. The press release identified information centers throughout the study area where citizens could review the Remedial Investigation/Feasibility (RI/FS) reports, describing data gathered throughout the study period and alternative remedies for dealing with the arsenic contamination.

The draft FS primarily identifies alternative solutions for contamination in private wells. The March 25 meeting, however, was attended mostly by people from the town of Lidgerwood who were concerned that they have to pay for a new municipal water treatment plant while EPA

is paying for solutions in the rural areas. A detailed summary of that public meeting, including citizen questions and NDSDH and EPA responses, is attached (Attachment A).

Two Fargo TV stations covered the public meeting, and newspapers in Fargo, Lidgerwood, Wahpeton, Grand Forks, and Bismarck published stories.

SUMMARY OF PUBLIC CONCERNS

Community concern at this site can be divided into two main categories -- municipal and rural. Both groups are concerned with the extent of contamination, health effects associated with low-level arsenic exposure, and economic ramifications of any solution.

MUNICIPAL

In late 1979, the NDSDH required the City of Lidgerwood to reduce arsenic levels in their drinking water supply. After the city evaluated several alternatives for achieving compliance with the State order, the city leaders decided to build a new water treatment plant.

The city requested approval and funding from EPA for the treatment plant. In a letter dated Nov. 22, 1982, Steven J. Durham, then Regional Administrator, stated that EPA was not in a position to provide funding to the city under the Safe Drinking Water Act, and that Superfund monies could not be used within the timeframe mandated by the State.

The City of Lidgerwood proceeded to build the treatment plant and levied a $970 charge per Lidgerwood household to pay for it. Citizens protested the charge, and now are voicing concern that they had to pay for their treatment plant while EPA has decided to construct a new rural water system (which Superfund will largely finance) for private well owners in the area.

RURAL

Private well owners in the study area were polled by the NDSDH in April 1986 and asked their preference in the selection of alternative remedies for arsenic contamination of their water supplies. Residents were given a synopsis of the four alternatives described in the Feasibility Study and asked to return a post card indicating their preferred alternative. A copy of the NDSDH letter to residents is attached (Attachment B). The State's Fact Sheet is on file.

Alternatives given were:

1. Do Nothing
2. Construct a Rural Water System
3. Install Activated Alumina Filters
4. Install Distillation System

In a letter sent with this survey, the NDSDH indicated that 90% of the construction costs for any of these alternatives would be provided by Superfund, with the remaining 10% State share being passed on to the residents. In addition, the letter said that all operation and maintenance costs would be the responsibility of the residents after the first year.

NDSDH received a 60% response on the survey, with 43% saying they preferred the "Do Nothing" option. Detailed survey results are attached (Attachment C).

REMOVAL ACTION AT THE SITE

During the summer of 1986, EPA initiated a two-part removal action designed to 1) determine the extent of contamination at the Wyndmere site and proceed with soil removal, and 2) begin installation of activated alumina filters or other suitable treatment on rural homes where residents indicated they wanted them. EPA's Emergency Response staff is working with NDSDH on a door-to-door survey to determine acceptability of the filters. Installation of three test systems is anticipated before the end of September 1986. Installation of the preferred system should begin on private wells sometime in October 1986.

EPA'S DECISION OF FINAL REMEDY

Based on the NDSDH survey, EPA's selected alternative of building a new water system for rural residents is not the preferred choice of citizens in the area. Most of the older citizens in the area don't believe arsenic in their water is a problem. However, some younger residents with children have shown concern.

NDSDH officials said they think a new rural water system will be looked at more favorably if EPA, under CERCLA reauthorization, pays for 90% of the construction cost and 90% of the operation and maintenance costs for ten years, rather than the present one year.

REMAINING CONCERNS

No design or construction can be taken at this site until Superfund is reauthorized.

The State of North Dakota must establish a funding mechanism to provide the 10% match required to build the system.

Another issue of concern is who will pay the O&M costs of a new rural water system after EPA funding runs out.

SUMMARY OF PUBLIC COMMENTS AT THE PUBLIC MEETING HELD MARCH 25, 1986 IN LIDGERWOOD

Purpose of Meeting

The purpose of this meeting was to present State Health Department findings on the ground water arsenic study in the Lidgerwood-Rutland-Wyndmere area and to present information on water treatment alternatives for arsenic removal.

Over 70 residents attended this meeting. Approximately 86% of those who signed the Public Meeting Attendance Sheet were Lidgerwood residents.

The majority of the public comments and questions at this meeting could be categorized into the following three areas:

I. Lidgerwood Water Treatment Plant

Eight questions and comments were directed to the Department concerning the Lidgerwood Water Treatment Plant, i.e., why Lidgerwood was required to put in this plant, why isn't the plant operational yet, why do residents have to pay for the plant when it is a "solution" for removal of the arsenic in their water and, also, how much arsenic will be removed when the plant is on-line.

Department's and EPA's Response -- The Department responded to the above-noted by indicating that the City of Lidgerwood was the only public water supply system in the State that consistently exceeded the federal and state Safe Drinking Water Act's Maximum Contaminant Level (MCL) for arsenic of 0.05 milligrams per liter. Because of this, it was necessary for the City to come into compliance by whatever means they would choose, either by finding an alternative water source or by treating their water.

The EPA and the State granted the City of Lidgerwood extensions to the Safe Drinking Water Act's 1981 deadline for all public water systems to come into compliance. The City of Lidgerwood then had time to develop and review their options and determine which alternative they felt would best meet their needs and resources. It was the City's decision to build a water treatment plant to remove iron and manganese. There is evidence that arsenic in the ionic form will co-precipitate with iron and manganese. The State approved this solution on an experimental basis with the proviso that the city will reduce the arsenic concentrations by other methods if this treatment process does not do a satisfactory job.

Construction was completed on the water treatment plant in early 1986; however, the plant has not been able to go into operation yet due to the necessity for cleaning out the water mains. After that the plant should be able to go "on line" and if it operates as projected, it should remove 90-95% of the arsenic. This amount of arsenic removal will bring the City's water into compliance with the Safe Drinking Water Act.

The question of why should the City of Lidgerwood and its residents have to pay the costs for their water treatment plant when it is a solution to

that city's arsenic problem was responded to by Walt Sandza, the EPA Superfund Project Officer. He indicated that he was willing to go back to EPA and double-check on whether the plant could possibly be eligible to receive Superfund funding.

II. Health Effects from Consumption of Arsenic-Contaminated Water

Nine questions and comments dealt with health effects, i.e., how does arsenic affect people and will the arsenic levels that residents are now seeing remain at current levels or get worse.

Department's and EPA's Response -- The Department's response to these questions is also contained within the "Health Risk Assessment -- Southeastern North Dakota Ground Water Arsenic Remedial Investigation": Arsenic is a toxicant which effects the whole body. Major effects of chronic, long-term arsenosis are seen in the kidneys, liver and skin. In the case of long-term chronic ingestion of arsenic, it appears that the rate of excretion approaches the intake rate.

Symptoms of long-term, chronic exposure to elevated levels of arsenic in drinking water include, but are not limited to, skin lesions (generally pre-cancerous), facial edema, numbness and tingling of the extremities, asthma, anemia, swelling of the liver, gastrointestinal damage, general vascular collapse and hearing loss.

Francis Schwindt, Water Supply & Pollution Control Division Director, stated that if individuals have or are experiencing any of these symptoms they should talk to their family or local doctors. Mr. Schwindt also indicated that the Department doesn't anticipate arsenic levels to increase from what they are now.

III. Superfund Funding

Ten questions and comments were directed to the Department regarding whether Superfund funding could pay for the Lidgerwood water treatment plant, what percent of funding could Superfund provide and why should local residents have to pay for the negative impacts from the use of the grasshopper poison bait supplied by the federal government.

Department's and EPA's Response — EPA indicated that they'd check on whether Superfund could provide funding for the Lidgerwood Water Treatment Plant. The level of EPA funding for the arsenic removal alternative(s) that the rural residents, the Department and EPA decide to go with, hasn't been established as of yet. Up to 90 percent of the initial construction cost of the implemented alternative and the first year's operational and maintenance costs could possibly be paid through the Superfund Program. The remaining 10 percent of the cost for the first year would then have to be paid by the homeowner. This area is one that EPA and the Department will further discuss and review.

In closing the meeting, the Department indicated that the public comment and review period would continue through March 31, 1986, and that local residents should feel free to contact us.

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EPA Representatives in Attendance

Marilyn Null, Community Relations Specialist
Walter Sandza, Superfund Site Project Officer

NDSDH Representatives in Attendance

Francis Schwindt, Water Supply & Pollution Control Director
Kris Roberts, Environmental Scientist
Dave Glatt, Environmental Engineer
Tim Safford, Environmental Engineer
Teri Lunde, Planner

ATTACHMENT B

April 9, 1986

Dear :

Over the past several years a study was conducted to determine the source and extent of arsenic contamination of groundwater in your area. Arsenic contamination information was collected from your well and several others in the area.

A followup study has identified alternatives to reduce the arsenic in drinking water supplies. Those alternatives have been categorized as point of use water treatment and rural water supply systems. A point of use water treatment system is designed to treat water at a single drinking water tap in the home. On the other hand, a rural water supply system provides water to a number of rural homes through a pipeline distribution system.

The information in the following pages has been compiled to give you a better understanding of the water treatment alternatives currently under study. Financial assistance may be available to offset the initial costs of a water treatment alternative. Up to 90 percent of the initial construction cost as well as the first year operational and maintenance costs would be paid through the Superfund Program of the U.S. Environmental Protection Agency (EPA). The remaining 10 percent of the cost for the first year would be paid by the owner. However, all expenses incurred after the first year shall be the responsibility of the owner. The extent to which assistance is provided will depend upon the local interest in the project area.

A survey is being conducted to determine what type of treatment, if any, that would be of most interest to you. Please return the enclosed stamped, self-addressed postcard with your ranking of the alternatives you would like to see used in the area. If you should have any questions regarding these alternatives or require additional information please feel free to contact me at: North Dakota State Department of Health, Division of Water Supply and Pollution Control, 1200 Missouri Avenue, Box 5520, Bismarck, ND 58502-5520 or phone (701) 224-2354.

Sincerely,

Tim Safford
Environmental Engineer
Water Supply & Pollution Control

TS:LDG:dn
Enc.

EPA NOTE: NDSDH Fact Sheet on file

State Capitol
Bismarck, North Dakota 58505

ENVIRONMENTAL HEALTH SECTI

1200 Missouri Avenue
Box 5520
Bismarck, North Dakota 58502-5

MEMORANDUM

TO : Teri Lunde
Environmental Health Section

FROM: L. David Glatt, Environmental Engineer
Water Supply & Pollution Control LDG

RE : FS Arsenic Remediation Survey

DATE: July 24, 1986

In April of this year each household identified as currently being at risk due to the exposure to elevated concentrations of arsenic in their drinking water supply were asked to respond to a survey conducted by this Department. The survey outlined several water treatment arsenic remediation alternatives such as a centralized rural water system and point of use home treatment systems. Each respondent was requested to indicate, in order of preference, those alternatives which they would consider most beneficial to them at this time. Enclosed please find the information forwarded to each individual at the time of the survey.

A total of 122 survey forms were distributed throughout the project area and 72 (59 percent) were returned. Listed below are the results of the survey:

Alternative	Number of Respondents	Percent
Do Nothing	31	43
Distillation	9	13
Activated Alumina	7	10
Reverse Osmosis	5	7
Rural Water System	5	7
New Well (Low Arsenic)	1	1
Iron Removal System	1	1
Point of Use (General)	2	3
Currently have Rural Water	10	14
No Longer Living in Area	1	1
	72	100%

It is important to note that a total of 30 respondents indicated they would prefer some type of remedial action in the form of water treatment.

There were not any written questions directed toward this Department which pertained to the arsenic study after the public meeting. Any questions directed toward this Department were answered during the public meeting held in Lidgerwood, North Dakota.

If you should require any additional information or have questions regarding this matter, please do not hesitate to contact Tim Safford or myself.

LDG:lb